a basic salt, the high atomic weight $R^{iv} = 236.3$. But I stated expressly, and I feel obliged to repeat it, that these fractions show a great tendency to form basic salts. Assuming these to be normal, a higher atomic weight than the true one is obtained. This is true especially in regard to the oxalate.

The splitting up of thorium into Th$\alpha$ and Th$\beta$ was, of course, not so sensational an event as the announcement from America of the splitting up of thorium into 'carolinium' and 'berzelium.'

BOHUSLAV BRAUNER.

Bohemian University, Prague,
April 18.

Those who have read my work and heard my recent paper delivered before the Washington, New York and North Carolina sections of the American Chemical Society do not require further information regarding the above. In view of the fact that many British men of science are not familiar with the work and may be misled, it has been deemed wise to despatch the following to the editor of *Nature*.

*Re Thorium.*—The elementary nature of thorium has been questioned by several workers, namely, Chroustschoff in 1889 (*J. russ. phys. Chem. Ges.*, 29, 206), Rutherford in 1899 (*Phil. Mag.*, 49, 2, 1900), Crookes in 1900 (*Proc. Roy. Soc.*, 66, 406) and in 1901 Brauner (*Proc. Chem. Soc.*, 17, 67) and Baskerville working independently (*Journ. Am. Chem. Soc.*, 23, 761). The methods employed were different in each case.

The undersigned has made no claim of priority as to the idea of the complexity of thorium, but he distinctly claims to have applied novel methods and an old one, which demonstrate to the satisfaction of himself and others familiar with the work, not only the complexity of old thorium, but the existence of two new elements to which the names of carolinium and berzelium have properly been given. The old method was used by Berzelius, who died thirty years before the plaintiff, according to his own statement (April 28, p. 606), began his work on the separation of the rare earths.

Scientific men will await the appearance of the paper, which will be published shortly in the *Journal of the American Chemical Society*, and see that all workers have received full credit for their share in the solution of the question. In the meantime, the letter adverted to, carrying much that is true and a distortion, which any one may verify by reference to the literature, to say the least is in poor taste.

For fear lest the old proverb, '*qui tacet consentire videtur*,' carry too much influence, the above statement is reluctantly made.

CHAS. BASKERVILLE.

UNIVERSITY OF NORTH CAROLINA, U. S. A.,
May 17, 1904.

### A REDDISH-BROWN SNOWFALL.

TO THE EDITOR OF SCIENCE: An incident which should, perhaps, be recorded is that of a reddish-brown snowfall which occurred at this place on February 2 last (1904). A light snow was falling on that day and about noon the character of the snow-fall changed to a reddish-brown or light chocolate color. This continued for half or three quarters of an hour, after which the snow-fall of ordinary appearance continued during the afternoon, the colored snow appearing as a well-defined layer between the white snow which fell before and after it. An examination under the microscope showed numerous irregular-shaped, semi-transparent particles with an appearance similar to feldspar. Nitric and muriatic acid applied to them gave no apparent result. Examined microscopically during the snow-fall it appeared that the particles were not carried on the snow, but were embedded in the snow crystals. Other ordinary contaminations were present, but were plainly distinguishable from the peculiar particles in the snow crystals. The phenomenon was observed in two or three near-by towns, but, so far as learned, not outside this immediate vicinity.

EDWARD LINDSEY.

WARREN, PA.,

## *SPECIAL ARTICLES.*

### MENTAL EFFICIENCY AND HEALTH.

IN the address as president of the American Society of Naturalists, read by Professor Cattell at the annual dinner, January 1, 1903, and printed in this journal, April 10, 1903, is inserted a table giving the grades for different

mental traits assigned by twelve independent judges to five American men of science.

Though these individuals are merely cited from a list of thousands in illustration of the methods employed in collecting data for the study of mental characters, the figures given in the table have an apparent bearing upon the question of the relation which exists between the quality and efficiency of a man's mental activity and his constitutional physical health. I should like to call attention to certain facts deducible from the table, and to express the hope that in preparing the results of the study for publication this aspect of the problem may not be overlooked.

Of the five persons graded one ranks very high in physical health, one is decidedly low, one falls close to the indifference line of the series, and the other two lie at points considerably above and below this mean. The range of physical variations is thus wide enough to enable one to observe clearly any mental and physical correlations which exist.

A glance at any one of the following sets of figures into which the table given on page 568 has been distributed, will show at once that certain marked features of correlation appear, but that the mental grading does not parallel throughout the variations in physical health. As regards individuals, *D* is so consistently divergent as to belong to a separate group from the other four, who present a fairly well-marked series of correlations. The grades of health in the five men, from which comparison proceeds, together with the average ranking of each in the whole series of mental traits are given in the following table:

| Men. | *D* | *A* | *B* | *C* | *E* |
|---|---|---|---|---|---|
| Health, | 90 | 63 | 55 | 26 | 12 |
| Traits, | 43.6 | 77.6 | 56.4 | 46.9 | 24.1 |

The grades, it will be recalled, are on a scale of 100. The letters indicating individuals in the original article are retained in the present tables. With the exception of *D* the estimation of general efficiency in the members of the group rises and falls with the condition of physical health. As these figures are the representatives of a set of curves which are not all consistent, I have distributed the twenty-three traits in several groups into which they seemed naturally to fall, and which may be described as follows: Mental range and balance, intellectual capacity, emotional sensibility, energy of will and social adaptiveness. The special traits included under these several heads are mentioned in connection with each set of figures.

| Men. | *D* | *A* | *B* | *C* | *E* |
|---|---|---|---|---|---|
| Mental balance, | 45 | 84 | 79 | 32 | 20 |
| Judgment, | 30 | 96 | 70 | 30 | 15 |
| Breadth, | 63 | 93 | 74 | 38 | 68 |
| Efficiency, | 34 | 100 | 57 | 74 | 4 |
| Average, | 43 | 93 | 70 | 43 | 27 |

I have included efficiency in this table because, as used in the paper, it seemed to have more affiliation here than with energy of will. It will be noted that the table presents only one individual divergence from the curve of health. The series grouped under intellectual capacity follows:

| Men. | *D* | *A* | *B* | *C* | *E* |
|---|---|---|---|---|---|
| Intellect, | 38 | 90 | 57 | 79 | 49 |
| Quickness, | 9 | 87 | 57 | 99 | 33 |
| Intensity, | 57 | 82 | 25 | 76 | 8 |
| Originality, | 66 | 82 | 17 | 84 | 8 |
| Clearness, | 17 | 90 | 74 | 72 | 45 |
| Average, | 37 | 86 | 46 | 82 | 29 |

The correlation in this group is less extensive than in the preceding. The same individuals stand at the top and bottom of the list —a pronounced condition of bodily weakness lowers efficiency here as elsewhere—but the series presents much greater individual irregularities. The following traits have been grouped under energy of will:

| Men. | *D* | *A* | *B* | *C* | *E* |
|---|---|---|---|---|---|
| Will, | 63 | 90 | 45 | 49 | 2 |
| Energy, | 77 | 98 | 32 | 90 | 3 |
| Perseverance, | 87 | 96 | 30 | 54 | 1 |
| Independence, | 52 | 94 | 57 | 72 | 5 |
| Courage, | 45 | 95 | 52 | 51 | 12 |
| Leadership, | 6 | 87 | 20 | 17 | 6 |
| Average, | 55 | 93 | 39 | 56 | 5 |

In this group of traits the extremes of efficiency are greatest and the falling off which accompanies constitutional weakness most marked. In the lowest of the group it is almost a negligible quantity. *D*'s grade

attains its maximum in this set of will-traits, as we should perhaps expect, yet his physical health suffices only to pull him to the middle of the group. The relatively high attainment of *C*, who is graded 26 in the indices of health, is to be noted. Only two traits seemed to fall naturally into the following group:

| Men. | *D* | *A* | *B* | *C* | *E* |
|---|---|---|---|---|---|
| Emotion, | 26 | 13 | 26 | 24 | 55 |
| Refinement, | 4 | 52 | 72 | 8 | 63 |
| Average, | 15 | 32 | 49 | 16 | 59 |

The curve presented here differs strikingly from all which preceded it. It is practically an inversion of the type. With the exception of *C*, in whom mental endowment and moral force have already been found in excess of physical vigor, this reciprocal correlation forms a continuous curve. The remaining traits concern various aspects of social adaptability, and have been grouped under a single head:

| Men. | *D* | *A* | *B* | *C* | *E* |
|---|---|---|---|---|---|
| Reasonableness, | 38 | 67 | 93 | 20 | 20 |
| Cooperativeness, | 38 | 63 | 49 | 19 | 10 |
| Unselfishness, | 45 | 38 | 67 | 10 | 17 |
| Kindliness, | 54 | 45 | 82 | 10 | 48 |
| Cheerfulness, | 34 | 48 | 77 | 34 | 26 |
| Integrity, | 76 | 96 | 87 | 38 | 38 |
| Average, | 47 | 59 | 76 | 22 | 26 |

For the first time in the series the maximum is removed downward to the middle of the group. The decline in adaptiveness—social virtues, in other words—is most pronounced in connection with conditions of poor health, but the falling off is important in the other direction also.

As to the significance of these curves, the material is of course altogether inadequate to justify general conclusions, but it is a very interesting fact that the correlation which every one in a way believes in, but would, perhaps, expect to be discernible only in large masses, is presented not only in general, but with characteristic variations even in this small group of individuals chosen at haphazard. If I may assume these five cases as the basis for comments to serve as suggestions for consideration in connection with larger mass of data, the following facts may be noted: Having regard to the main group of four, breadth and sanity of mind, together with executive ability, vary directly with conditions of physical health; but the distribution of original mental endowment, quickness and clearness of grasp, appears independently of its variations. Of all the traits here enumerated the virtues of will—energy, courage, capacity for leadership—fall off most rapidly with extreme degrees of physical weakness; but the efficiency of the individual can not be predicted in the middle ranges of health. The curve of social adaptability reached its maximum in the middle of the group. Reasonableness, unselfishness and the like are apparently not the virtues of the strong; as they are likewise not the marks of a frail or nervously unstable constitution, for which all complex human relations become irksome. If the induction were not based upon so fragmentary a series of observations, one might look upon this curve as indicating the ultimate dependence of sympathy and social integrity upon physical conditions which give rise to a sense of the need of aid, and that these instincts show a decline of intensity in those of rugged strength.

The curve of emotional sensibility and refinement rises with delicacy of constitution, its maximum appearing in the weakest, its minimum in the most robust, member of the group. In connection with this point it may be worth while to observe whether the approach to perfection of physical health is in general—as here—characterized by a more or less marked decline, instead of a continuous rise in general mental efficiency. Without going so far as W. D. Howells, who, in commenting upon Gould's 'Biographic Clinics,' suggests that the ill-health of Carlyle, De Quincey, Huxley and others might, perhaps, be considered an important factor in their intellectual productiveness, it may well be questioned whether a man is not handicapped rather than favored in regard to mental efficiency by being a perfectly healthy animal. The former functions depend in a peculiar sense upon the development and activeness of the nervous system, the latter upon digestional integrity and adequate nutrition of the muscu-

lar tissues. Mental capacity and vigor may depend upon an upsetting of the physiological balance and the aggrandizement of the central nervous system at the expense of these other processes. Great prosperity in the vegetative functions—which we call physical health—would thus be inimical to the highest intellectual enterprise, and the case of *D* would be made characteristic instead of anomalous. It is at least suggestive that the eupeptic maximum in adults is found in connection with the first stages of general paralysis.

The gist of the figures contained in the table, theorizing apart, is sufficiently indicative of the importance of physical vigor as a condition of mental activity to make the matter worthy of consideration in future study.

Robert MacDougall.
New York University.

## *THE ELECTRON THEORY.*

Professor J. J. Thomson in the March number of the *Philosophical Magazine* discusses the theory of the stability of systems of electrons. His conclusion is that a number of electrons constitute a stable system when they are grouped in a series of concentric circular rings, very similar to Saturn's rings, which rotate about a common axis. Stability depends upon two conditions, namely, (*a*) upon a certain minimum angular velocity of rotation of a ring, and (*b*) upon the presence of at least $f(n)$ electrons at or near the center of a ring containing $n$ electrons. Stability increases when the angular velocity increases above the critical value and when the number of internal particles is greater than $f(n)$; $f(n)$ being a definite function of $n$.

The first part of Professor Thomson's paper is devoted to the establishment of the two conditions of stability (*a*) and (*b*) and the second part of the paper is devoted to the application of these results to the theory of the constitution of the atom. The features of the second part are:

1. A brief discussion of the types of oscillation of systems of electrons and the application of these results to the rationalization of spectra. Professor Thomson goes no farther than to show in a general way that the spectral lines of a given element may be grouped in a number of series of related lines, and that the different chemical elements of a group or family, such as the alkali metals, may have closely related series of lines. This same idea has been advanced by H. Nagaoka, of Tokyo, who promises soon to publish a paper devoted to this method of classifying spectra.

2. A full discussion of the relations between stable systems containing greater and greater numbers of electrons, and the application of these results to the rationalization of Mendeléef's periodic law. In this section of the paper Professor Thomson shows that a system of electrons furnishes a dynamic model which, with increasing numbers of electrons, exhibits properties closely analogous to those remarkable periodic variations of valency of the chemical elements with increasing atomic weight. This constitutes the first suggestion of anything worthy to be called a rational basis of Mendeléef's law, and its importance can scarcely be overestimated. It is, perhaps, the greatest contribution to theoretical physics during a decade. In this section of his paper Professor Thomson discusses the process of chemical combination in terms of his theory and he suggests an explanation of the catalytic action of water and of a metal such as platinum.

3. An application of the fact that the stability of a system of electrons depends upon a certain minimum angular velocity of the electron rings, to the explanation of radioactivity.

It is the purpose of this note merely to call attention to Professor Thomson's paper, which should be carefully read by every student of chemistry, and to give to the reader a sufficiently clear idea of the electron to enable him to fully appreciate Professor Thomson's theory of the structure of the atom.

It is not to be expected, of course, that a new hypothesis should lead at once to anything approaching a completely consistent theory and it may be helpful to readers of Professor Thomson's article to point out the weak points of his theory.